**The Sine and Cosine Functions**

The anatomy of a sinusoidal curve

Transformations of sinusoidal curves









**Exploring Transformations:**

Use Geometer’s Sketchpad to explore the affects of **a**, **b**, and **d** on the graphs of sine and cosine:

 and 

**Setup:**

1. Open a new Sketch on GSP and change Preferences(Edit menu) to Radian measure for angles.
2. Define the Coordinate System. (Graph menu)
3. Define parameters a, b, and d. (Graph menu) Initally, set a=1, b=1, and d=0
4. Plot a new Function (graph menu). The new function will be , but you must use “x” for the input instead of theta.

 and 

**Explore:**

1. Play with the value of the parameter a. Make sure you sample fractional values of a and negative values of a. Check that your observations are valid for **both** the sine and cosine curve.

**Question:** What affect does **a** have on the sinusoidal curve? Be specific. Is this affect consistent with other functions and transformations we have studied?

The value of a affects the amplitude. If a is negative, then the graph is reflected over the **line of equilibrium**. Amplitude, however, is always positive because it is the *distance* from the peak of the graph to the line of equilibrium.

So, |a|= amplitude

If a < 0, then the curve is reflected over the **line of equilibrium**.

1. Reset a to 1. Play with the value of the parameter d.

**Question:** What affect does **d** have on the sinusoidal curve? Be specific. Is this affect consistent with other functions and transformations we have studied?

When d is positive, the whole graph shifts up d units. When it is negative the whole graph shifts down d units.

So, d = vertical shift.

1. Reset d to 0. Play with the value of the parameter b.

**Question:** What affect does **b** have on the sinusoidal curve? Be specific. Is this affect consistent with other functions and transformations we have studied?

b affects how tight the curve is or how stretched out it is. The bigger the value of b the more often the curve goes up and down. In other words, if b>1, the period gets smaller, and if 0<b<1, the period gets larger. For example when b = 2, the period halved and when b=3, the period was one third of the normal period. When b = ½ the period doubled, and so forth.

**What is the relationship between b and period?**

period = 

**Confirm your results:**

1. Based on your observations, sketch the following graphs (by hand), and then check the results using GSP.

















